

REMARKS

This Preliminary Amendment cancels without prejudice original claims 1-5 in the underlying PCT Application No. PCT/DE03/00613, and adds new claims 6-10. The new claims conform to U.S. Patent and Trademark Office rules and do not add new matter to the application.


In accordance with 37 C.F.R. § 1.125(b), the Substitute Specification (including the Abstract, but without the claims) contains no new matter. The amendments reflected in the Substitute Specification (including Abstract) are to conform the Specification and Abstract to U.S. Patent and Trademark Office rules or to correct informalities. As required by 37 C.F.R. § 1.121(b)(3)(ii) and § 1.125(c), a Marked Up Version Of The Substitute Specification comparing the Specification of record and the Substitute Specification also accompanies this Preliminary Amendment. Approval and entry of the Substitute Specification (including Abstract) are respectfully requested.

The underlying PCT Application No. PCT/DE03/00613 includes an International Search Report, dated June 26, 2003. The Search Report includes a list of documents that were uncovered in the underlying PCT Application. A copy of the Search Report accompanies this Preliminary Amendment.

Applicants assert that the subject matter of the present application is new, non-obvious, and useful. Prompt consideration and allowance of the application are respectfully requested.

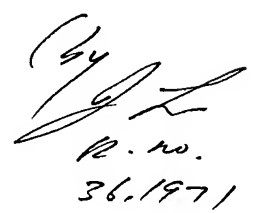
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5 DEVICE IN A VEHICLE FOR MONITORING THE ENVIRONMENT
AROUND A VEHICLE

~~Background Information~~ Field of The Invention

10 The present invention ~~is directed~~ relates to a device in a vehicle for monitoring the environment around a vehicle according to the definition of the species of the independent Claim.

15 Background Information

Published European patent document EP 550 852 A1 describes a device in a vehicle for monitoring the surroundings, including an environment sensor system having a predetermined detection
20 range, an analysis module being provided for analyzing a signal from the environment sensor system.

~~Advantages of the Invention~~ Summary

25 The device according to the present invention in a vehicle for monitoring the environment around a vehicle ~~having the features of the independent patent claim~~ has the advantage over the related art that by selecting objects by interpretation of the environment and the situation, the
30 environment sensor system limits itself to pre-crash-relevant objects. This selection is advantageous for reporting only those objects which might actually result in an accident. This permits better differentiation of between crash-relevant objects and non-crash-relevant objects to prevent ~~eases of~~
35 ~~misuse in particular~~ instances of misinterpretation.

~~Through the measures and refinements characterized in the dependent claims, advantageous improvements on the device in a vehicle for monitoring the environment around a vehicle as characterized in the independent claim are possible.~~

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It is particularly advantageous that the parameters according to which the device according to the present invention selects the relevant objects include the relative speed between the vehicle and the particular object, the direction of the
10 relative speed, and the curve radius, as well as the type of traffic. The type of traffic is understood to refer, for example, to whether there is right-hand traffic or left-hand traffic. ~~The starting point is~~ device includes a sensor system having one or more sensors which detect objects
15 continuously. The detection range has a fixed beam angle and a fixed range. A great many objects may be detected in the detection range of the sensor system.

Depending on the driving situation, there are a number of
20 parameters which make it possible to reduce the attention window. The attention window is also based on the probability of occurrence of objects in this range.

First, there is the distance in front of the vehicle as a
25 function of the relative speed or in a special case only the vehicle speed if the time is fixed. Thus, for example, a reversible seatbelt tightening device will always have the same activation time. Accordingly, the attention window must also be increased in the x direction as the speeds become
30 higher, in order to provide the appropriate time for the restraint means, by tracking objects in a larger area.

The attention window in the y direction, i.e., in the transverse direction, depends on the relative speed between
35 the vehicle and the object. At high speeds, the probability for objects approaching the vehicle at a larger angle of

approach is relatively low. Accordingly, the attention window in the y direction may be selected to be smaller.

The same is also true of passing vehicles, which occur every day on rural roads and communities. The distance from passing vehicles is a function of speed.

The attention window in y direction is a function of the curve radius. A small curve radius requires a large attention window in the y direction.

For the interpretation of driving situations, another factor to be taken into account is whether traffic is left-hand or right-hand traffic. Thus, in the case of right-hand traffic, automobiles being parked or automobiles to be passed, and thus having a low relative speed, are detected on the right. Vehicles coming from the opposite direction and coming at a high relative speed are detected on the left.

In addition, it is advantageous that the analyzer unit of the device according to the present invention is connectable to at least one restraint means, so that the analyzer unit triggers the at least one restraint means as a function of the tracking of the at least one object. In particular, when the object is on a collision course with one's own vehicle and the distance is less than ~~that necessary to deploy~~ a threshold distance for deploying a reversible restraint means such as seatbelt tightening systems ~~if the speed remains the same~~, then the analyzer unit will generate a triggering signal to deploy the corresponding restraint means.

It is advantageous that the restraint means are designed to be reversible or at least partially reversible. This includes ~~in particular~~, e.g., reversible seatbelt tightening systems or an extensible bumper.

Drawing

~~Exemplary embodiments of the present invention are depicted in the drawing and explained in greater detail in the following~~
5 ~~description.~~

Brief Description of The Drawings

Figure 1 shows a block diagram of the device according to the
10 present invention.

~~Figure 2 shows~~ Figures 2a and 2b show two situations illustrating the functioning of the device according to the present invention; ~~and.~~
15

Figure 3 shows a flow chart of ~~the~~ an example method running on the device according to the present invention.

~~Description of the Exemplary Embodiment~~ Detailed Description

20 In the future new functions will be developed for drivers to support them in driving a vehicle. These functions will include both comfort functions and safety functions. With regard to the safety functions, the pre-crash function will
25 assume an important role because detecting an imminent collision is extremely important in reducing the severity of the collision for the occupants of the vehicle. In particular it may also be possible here to prevent the collision completely. However, it is problematical that during a normal
30 driving operation, many objects may be detected in the area in front of a vehicle. According to the present invention, a device is ~~now proposed~~ provided for monitoring the environment and interpreting the environment ~~and situations~~ in order to select only those objects which might also be hazardous and
35 crash-relevant in the sense of protecting the occupants of the vehicle.

Figure 1 shows a block diagram of an example embodiment of the device according to the present invention. A sensor system 1 is connected to an analyzer unit 2 via a data output.

5 Analyzer unit 2 is connected to a control unit for restraint means 3 via a data input/output. This control unit 3 is in turn connected to a reversible seatbelt tightening system 4 via a first data output, to an extensible bumper 5 via a second data output and to airbags 6 in the vehicle via a third
10 data output.

Sensor system 1 here includes distance sensors, which are also understood to include environment sensors such as video, radar, ultrasound or even infrared sensors suitable for
15 monitoring the environment. Control unit 3 is also connected to impact sensors (not shown here) which detect an actual crash. These are ~~mostly~~ may be acceleration sensors, but deformation sensors may also be used here. Sensor system 1 supplies a digital data stream to analyzer module 2. Sensor
20 system 1 therefore has signal processing and an analog-digital converter. Analyzer module 2 may be a processor or dedicated hardware, i.e., an integrated circuit produced for this purpose. Sensor system 1 and analyzer module 2 may both be situated in one housing. However, sensor system 1 may also be
25 situated in an offset position from analyzer module 2, so that different video sensors mounted on the vehicle, for example, may be connected to just one analyzer module 2. With such an offset connection, it is possible for either each individual sensor of sensor system 1 to be connected to analyzer module 2
30 by a two-wire line, or for an entire sensor bus to be used to connect the individual sensors of sensor system 1 to analyzer module 2, e.g., as a bus master. The connection may be implemented electrically, optically or via radio waves. If analyzer module 2 is offset from sensor system 1, then this
35 analyzer module 2 functions as a control unit and may, if necessary, also be set up in one housing with control unit 3.

If analyzer module 2 and control unit 3 are installed in different housings, then the connection between them is implemented either by a two-wire line or ~~again~~ by a bus which interconnects a plurality of control units.

5

Control unit 3 itself calculates the deployment algorithm for restraint means 4, 5 and 6. The signal from sensor system 1 is also used to deploy reversible restraint means ~~in particular~~, such as seatbelt tightening system 4 and
10 extensible bumper 5, even before the impact. An adaptive airbag which is inflated relatively gently, i.e., with a short inflation time, may already be deployed before the actual collision. Other parameters that enter into the deployment
15 algorithm include the signals from the impact sensors, i.e., the acceleration sensors, for example, as mentioned above.

According to the present invention, analyzer unit 2 selects from the objects recognized by sensor system 1 those which might be relevant for causing a collision, taking into account
20 parameters such as the relative speed between these objects and the vehicle, their direction, and the driving situation, as well as the properties of the road surface. Thus the available resources are used for the potentially hazardous objects and not for non-hazardous objects, so there is no loss
25 of performance due to a ~~plurality unnecessary tracking of irrelevant~~ objects. On the other hand, due to the selection of objects the occurrence of misuse cases, i.e., non-deployment cases in which the devices are nevertheless
30 deployed, is prevented.

30

The selected objects are then tracked by sensor system 1. If analyzer module 2 recognizes that an object being tracked is closer than a predetermined distance from the vehicle, a signal is transmitted to control unit 3 indicating that the
35 restraint means that are the first to be deployed should be deployed. These include ~~in particular~~, e.g., reversible

seatbelt tightening systems. This predetermined distance around the vehicle is thus a time limit for the use of such restraint means. However, even after the distance drops to less than this predetermined distance, the object is still
5 tracked in order to be able to have precise information regarding a possible future collision, to thereby achieve an adaptive use of restraint means. Several such distance values may be preselected to determine an optimum time for deployment of ~~these restraint means for~~ the particular restraint means as
10 a function of ~~their~~ the respective deployment time.

~~Figure 2 shows in subfigures A and B~~ Figures 2a and 2b show two typical situations for the use of the device according to the present invention. A vehicle 7 has a detection range 8 ~~via~~
15 for its sensor system 1, this detection range being monitored continuously by the sensor system, e.g., by radar. If a vehicle 10 enters detection range 8, this situation is detected by sensor system 1 and parameters such as relative speed and its direction relative to vehicle 7 are determined.
20 As a function of these parameters, an attention range 9 is defined having a predetermined distance 13 such that when an object such as vehicle 10 comes closer than this distance 13, restraint means such as reversible seatbelt tightening device 4 are deployed. The vehicle speed here shown in Figure 2a is
25 much higher than that shown in Figure 2b, so that the attention range 9 extends to the outer limit of detection range 8.

In Figure 2b, a vehicle 15 has a sensor system 1, ~~again~~ having
30 detection range 8 and attention range 12. Here, too, distance boundary 14 is defined; when an object comes within this boundary, reversible seatbelt tightening system 4 is deployed. Vehicle 11 is traveling transversely to the direction of travel of ~~one's own~~ vehicle 15. The relative speed between
35 vehicles 15 and 11 is much lower here than that in Figure 2a between vehicles 7 and 10. Therefore, attention range 12 may

be much smaller than attention range 9.

Figure 3 shows a flow chart for the method ~~which runs on the device~~ according to the present invention, ~~in particular which~~
5 method may be run on the analyzer unit or module 2. In method step 20, objects in detection range 9 are detected with the help of sensor system 1 and analyzer module 2. The parameters are then determined in method step ~~1~~ 21, with the relative speed between one's own vehicle and the detected objects being
10 determined in this case. The direction of the relative speed is also determined here in order to be able to estimate whether a collision is imminent. Additional parameters which ~~enter into this~~ may be considered include the curve radius and the type of traffic, i.e., traffic on the right or left.
15 Other data such as the driving behavior of the other objects may also be included as parameters here. The individual parameters are weighted to derive a conclusion namely in method step 22 regarding which objects are relevant and must be subjected to tracking, which is performed in method step
20 23, to deploy the restraint means as soon as possible in the event of an imminent crash.

In method step 24 monitoring is performed to determine whether the objects tracked have a high likelihood of causing a
25 collision with one's own vehicle. This is monitored on the basis of predetermined distances 13 or 14, namely whether an object is within these distances. If ~~one's own vehicle a~~ tracked object comes within such a safety distance, there is a switch from method step 24 to method step 25 to deploy the
30 particular restraint means associated with this distance ~~limit~~ not being reached breached. However, if a collision is not imminent based on the test in method step 24, tracking of the object is continued in method step 23. Several objects may be tracked simultaneously, but this number should be as low as
35 possible to achieve effective utilization of resources of the available hardware and software. If the number of objects to

be tracked is too high, the response time of the device according to the present invention ~~would~~ may be ~~greatly~~ reduced.

Abstract

ABSTRACT

A device is provided in a vehicle for monitoring the environment around a the vehicle ~~is described,~~ characterized
5 ~~in~~ The device includes a sensor system such that objects in a detection range of the sensor system are selected as a function of predetermined parameters so that only the selected objects are tracked by the sensor system. This permits adaptive use of reversible restraint means ~~in particular~~ based
10 on the sensor system output.

~~(Figure 1)~~